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# STRIPING & PAINTING EQUIPMENT GUIDEBOOK

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MONTANA DEPARTMENT  
of  
HIGHWAYS

MAINTENANCE & EQUIPMENT DIVISION

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STRIPING & PAINTING EQUIPMENT  
GUIDEBOOK

MONTANA DEPARTMENT OF HIGHWAYS  
MAINTENANCE & EQUIPMENT DIVISION

APRIL 1987

ROY SYMONS - TRAINING OFFICER  
MAINTENANCE & EQUIPMENT DIVISION

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## INTRODUCTION

Pavement markings are essential guides to driver safety. Properly applied pavement markings provide drivers with guidance and information without their having to look away from the roadway. They become more important at night, as many visual cues that assist drivers during daylight hours are out of the range of the headlights. Unfortunately, when they are needed the most, many pavement markings perform the worst. Some pavement markings that can be plainly seen in the daylight are nearly invisible at night. All pavement markings must be reflective unless they are located in an illuminated area.

Pavement markings must conform to the Manual on Uniform Traffic Control Devices. The Traffic Unit of the Department of Highways prepared the Pavement Markings manual that explains what type of line to use.

This guidebook has been prepared to supplement instruction that will help you identify good stripes and what you can do to improve your pavement markings regardless of the age or type of equipment you operate.



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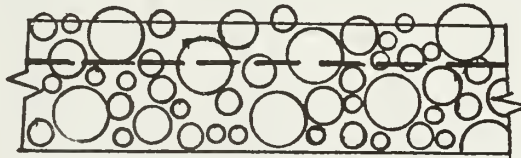
## GENERAL INFORMATION

Painted pavement markings bond two materials, traffic paint and reflective glass beads, to the roadway. The Department has specifications for the paint, the beads and the rate of application.

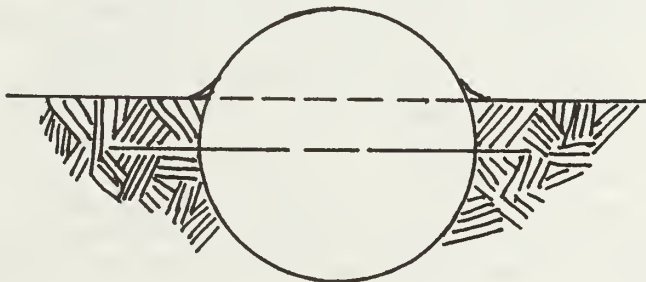
The paint must be 59-61% nonvolatile residual materials. This portion carries the pigment and other components that remain when the paint dries. The remainder of the wet paint is the alkyd resin vehicle that carries the residual materials in the liquid state.

The glass beads must be spherical, transparent and have smooth, lustrous surfaces. The beads can have up to 25% irregularly shaped particles. This is a cost consideration and even irregular particles can provide some retroreflectance. The beads also have to meet gradation specifications.

The gradation of the beads could be compared to a graded aggregate for a paving mix. There must be enough paint to hold the beads in place. The various sizes of particles allow for new beads to be exposed as the material wears.

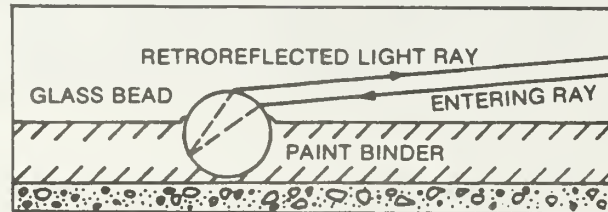


The paint performs two functions relative to the beads. It forms a bonding material to hold the beads in place. Beads that are not at least 60% embedded in the paint will usually be lost.



The paint must be applied in a thickness of 15 mils wet. With paint that is approximately 60% residual materials, there will be a dry film of about 10 mils.

The other function the paint performs is to reflect the light back through the beads. The light enters and passes through the bead,



strikes the paint on the opposite side of the bead and reflects back through the bead. The proper combination of beads and paint is 6 pounds of beads per gallon of paint applied at 15 mils of thickness wet.

GALLON/MILE TABLE

MIL RATE	GALLONS/MILE		
	Solid Line	9'-15' Cycle	10'-30' Cycle
10	11.0	4.1	2.7
11	12.1	4.5	3.0
12	13.2	4.9	3.3
13	14.3	5.3	3.6
14	15.4	5.8	3.8
15	16.5	6.2	4.1
16	17.6	6.6	4.4
17	18.7	7.0	4.7
18	19.7	7.4	4.9
19	20.8	7.8	5.2
20	21.9	8.2	5.5

Consistent quality of pavement markings can be affected by many factors. The thickness of the paint can depend on system pressure and the speed of the striper. The clarity of the line can change with the conditions of the guns, system pressure and wind speed. The reflectivity depends on getting enough beads in the paint and their staying there. Gun wear and performance, wind and system pressure all will affect bead placement. These problems and others can be identified by performing a few simple test passes before leaving the yard.

Test passes should check each gun, gun control functions, skip cycle, lengths, bead application, paint thickness, bead distribution and line width. Run the test passes in an area that is large enough to get the striper up to normal application speed and spary two skip cycles.

- Spray two skip cycles with each gun. Measure the width and length of the lines and the length of the skips. Observe the ends and edges of the lines for uniformity and over-spray.
- Make enough passes to check the change functions on each gun. Change from skip to solid and back again on each gun.
- Check bead distribution on the stripes. The beads should uniformly cover the width of the stripe. The bead guns should also be timed to completely cover the strip from end to end. There should not be any bare spots on either end of a stripe. The specification calls for six pounds of beads per gallon of paint.
- Check thickness with a wet film gauge. Spray a test pass from each gun on a fairly rigid, hard surface material like an old sign or a file folder. These test passes should be made with the bead guns turned off. The maintenance specification for thickness is 15 mils wet thickness.

If you identify some problems with your test passes, correct the problems before you go out to the job. By troubleshooting you can try some of the following corrective measures.

- If the paint is too thin:
  - \* Reduce the speed of the striper.
  - \* Increase the paint system pressure.
  - \* Check the needle valve for wear and proper adjustment.
  - \* Check the guns and supply lines for obstructions.

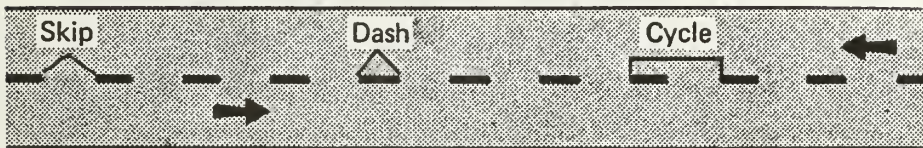
- If there is excessive overspray:
  - \* Reduce the paint system pressure.
  - \* Reduce the bead system pressure.
  - \* Check the fluid tip for wear.
  - \* Check the needle valve adjustment.
  - \* Clean the shroud.
- If the stripes are not the proper width:
  - \* Adjust the gun height.
  - \* Adjust the paint system pressure.
- If there is incomplete paint coverage:
  - \* Increase the paint system pressure.
  - \* Check the needle valve for wear and proper adjustment.
  - \* Check the fluid tip for wear.
  - \* Clean the shroud.
- If there is incomplete bead coverage:
  - \* Adjust the bead system pressure.
  - \* Adjust the height of the bead gun.
  - \* Check the bead orifice for wear.
  - \* Check for obstructions in the supply system.
  - \* Check the valve adjustment.
  - \* Make lateral adjustments as needed.
  - \* Adjust timing to cover each end of the line.
- If the skip cycle is not the proper length:
  - \* Fine-tune the timing device for the dash length or the skip length.
  - \* Check the solenoid switches.
  - \* Check the gun function switches.
- If the gun functions don't change properly:
  - \* Check the control switches.
  - \* Check the solenoids.
  - \* Check the guns.

## TERMS AND DEFINITIONS

- A. Skip line -- Broken center line
- B. Dash -- Painted part of a skip line
- C. Skip -- Unpainted part of a skip line
- D. Cycle -- Dash-skip pattern beginning at start of one dash and ending at start of next dash

(NOTE: Cycles vary according to use and state policy.)

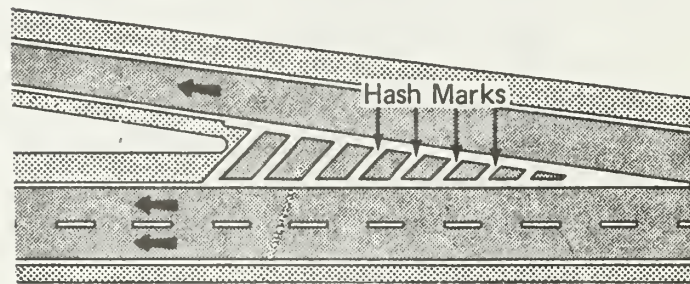
EXAMPLE: 10' dash, 30' skip = 40' cycle  
9' dash, 15' skip = 24' cycle



- E. Two-lane center line -- Yellow dashed or solid line indicating passing and no-passing zones on two-lane, two-way roadways
  - F. Multilane roadway lane lines -- Dashed white lines separating traffic traveling in the same direction
  - G. Edge-line -- Solid stripe along outside of traffic lane
- (NOTE: A solid white line indicates no opposing traffic. A solid yellow line indicates opposing traffic on the other side of the yellow line.)
- H. Hash marks -- 24" wide marks at 30° to the direction of traffic identifying areas such as islands and gores, where traffic is prohibited.



- I. Gore -- Line which guides approaching traffic around obstacles; also marks departures, such as exit ramps, from the main roadway; usually V-shaped



- J. Glass beads -- Glass spheres embedded in the paint to reflect light
- K. Atomize -- To reduce to a fine spray by the tearing action of air
- L. Internal atomization -- Paint atomized inside the spray gun
- M. External atomization -- Paint atomized as it sprays out of the gun
- N. Regulator -- Device that maintains pressure at a preset level
- O. Separator -- Device that removes condensed water and oil from air lines
- P. Shroud -- Cover or guard which focuses spray pattern and makes a clean edge
- Q. Agitator -- Device for stirring paint to keep it from separating
- R. Timing wheel (skip wheel) -- Device that sends electrical impulses to set cycle and measure number of feet painted
- S. Solid-state timer -- Computerized device for operating paint and bead guns in cycle

## TYPES OF PAINT DELIVERY SYSTEMS

Paint delivery systems have many different characteristics and components. Systems may use cold or heated paint and may have external or internal atomization. All systems include a filtering process. They have pressurized or gravity-fed systems for bead application. The paint tanks may or may not have agitators. The following descriptions are the most commonly used systems.

- A. Pressure pot -- Material is moved by air pressure from pressurized tanks to guns
- B. Pump pressure feed -- Material is pumped from unpressurized barrels or tanks to guns
- C. Zero-pressure feed -- Material is gravity-fed to a diaphragm or gear pump and then pumped under pressure to guns
- D. Siphon feed -- Material is drawn by suction from holding tank to gun
- E. Airless atomization -- Material is pumped from an unpressurized tank, agitated, fed to high-pressure pumps, and sprayed under extreme pressure

(CAUTION: An airless system delivers paint at extremely high pressure. The pressure atomizes the paint and is strong enough to force paint directly into body tissue. If this happens see a doctor for immediate treatment.)

## PUMP PRESSURE OPERATING SYSTEMS

- A. White paint system -- Transfer pump moves paint from barrels through filter to surge tank and then to right gun; has crossover line to left
- B. Yellow paint system -- Transfer pump moves paint from barrels through filter to surge tank and then to left gun; has crossover line to right
- C. Air system -- Compressed air operates pumps, carriages, and timing wheel

D. Solvent system -- Pump on barrel or tank moves solvent to guns for cleaning lines and nozzles

E. Alcohol system -- Pump moves material into air lines between filter and guns to keep out condensation in cold weather

(NOTE: Alcohol is recirculated back to holding tank after use.)

F. Surge tank -- Collects supply of paint for delivery to guns; keeps pressure constant at nozzles

(NOTE: Without a surge-tank system, the paint flow would surge and slow with the piston action of the pump.)

#### PRESSURE POT OPERATING SYSTEMS

A. White paint system -- Usually located on right side of truck with a crossover to the left; material under pressure flows from tank through filters, heat exchanger, screen strainer, and then to guns

B. Yellow paint system -- Usually located on left side of truck with a crossover to the right; material under pressure flows from tank through filters, heat exchanger, screen strainer, and then to guns

C. Glass bead system -- Pressure forces material from tank to guns

D. Air system -- Compressed air flows from compressor to pressure tanks, regulators and nozzles

(NOTE: Application of air system will vary with each machine. Generally, air pressurizes the paint, bead, and solvent tanks, atomizes paint at the nozzle, keeps the timing wheel on the ground, and operates the agitator motors.)

E. Solvent system -- Material flows from tank through lines to nozzles; can be directed through individual atomizing air lines to nozzles as needed



- F. Heat exchange system -- Glycol is heated and circulated through exchanger; paint line runs through exchanger and absorbs heat

(NOTE: The exchanger operates like a radiator. Glycol may be heated by a diesel-fired heater, or through the radiator and exhaust system, or by some other method. A circulating pump moves the heated solution through the exchangers. Heating fins absorb and hold the heat so that when the paint line passes through the exchanger, heat is transferred to the paint. There is a separate heat exchanger for each color of paint.

- G. Hydraulic system -- Operates pump, carriages, and guide assembly

(NOTE: The hydraulic system will vary with each machine.)

#### REGULATING PUMP PRESSURE

- A. Use higher pressure in the morning, and decrease pressure as cold paint warms up
- B. Adjust pressure as needed for different road surfaces

EXAMPLE: Initial application on a new chip-seal may require increased thickness to get adequate coverage and bead retention.

- C. Keep pressure adjusted so that paint is even and edges are clean
- D. Increase pressure to gun if paint is thin or spotty
- E. Decrease pressure if paint splatters
- F. Adjust bead pressure as needed

EXAMPLE: With pressure too low, beads won't go to the edges of the line; with pressure too high, the beads will break the static pressure that holds up the edge of the paint and pour out over the edges.

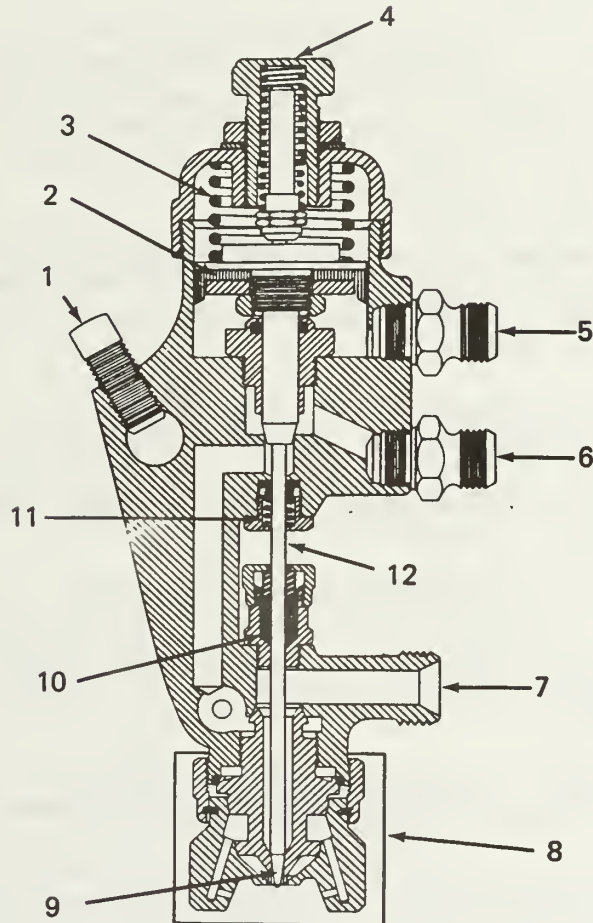
- G. Replace diaphragm and clean needle valve as needed

EXAMPLE: Sporadic material application that can't be corrected with pressure adjustments could be caused by spray gun failures.

- H. Lower pressure by adjusting regulator and relieving pressure at relief valves

# PARTS OF A TYPICAL SPRAY GUN NOZZLE

- |                             |                         |
|-----------------------------|-------------------------|
| 1. Mounting lock-screw      | 7. Fluid intake         |
| 2. Leather plunger (piston) | 8. Shroud               |
| 3. Piston spring            | 9. Fluid tip            |
| 4. Fluid adjusting nut      | 10. Packing             |
| 5. Operating air intake     | 11. Needle valve spring |
| 6. Atomizing air intake     | 12. Needle              |



Binks Manufacturing Company

## SAFETY RULES

Prevention of accidents involving equipment is completely dependent on the person operating the equipment. No power-driven equipment, regardless of the type or the purpose for which it is used, can be safer than the operator. The manufacturers incorporate features to make the operator's job safer and controls to make it easier. However, AVOIDING SITUATIONS THAT MAY PRODUCE ACCIDENTS IS SOLELY UP TO THE PERSONS AT THE CONTROLS, TO THEIR FORETHOUGHT, JUDGMENT AND COORDINATION. A careful operator is the greatest safety device there is.

With all the safety features, which have been incorporated in the design of the equipment, there are still dangers. The operator must be extremely careful in the operation of any equipment. To help prevent accidents, observe the following safety rules at all times:

1. Become well acquainted with the piece of equipment, Operator's Manual, and Maintenance Manual. Know the location and function of all controls.
2. Obey the instructions on warning decals located in areas of possible danger.
3. Be sure no one is under or around the machine before starting.
4. Look for leaks and check fluid levels.
5. Clean your shoes of slippery materials to prevent slipping on steps, or off of foot pedals.
6. Always face machine when mounting and dismounting. Never jump from any machine.
7. Always maintain a firm grip on the hand holds while entering or leaving the machine.
8. Keep the operator's platform free of debris.
9. Keep windshield, windows and mirrors clean at all times.
10. Check all controls to be sure they are operating correctly and are properly adjusted.

11. Never operate machine in a closed shed or garage; open the doors or windows to provide adequate ventilation.
12. Do not oil, grease, or adjust the machine when the engine is running.
13. Keep brakes in proper adjustment. If you can't stop the machine, don't start it.
14. Drive at speeds slow enough to ensure safety and complete control.
15. To prevent highway accidents, use warning signs and turn on yellow flashing lights whenever working on road surface.
16. Do not leave the machine unattended with the engine running.
17. Always cool engine 3 to 5 minutes, secure the equipment properly, and set parking brake before shutdown.
18. Be sure to shut off the engine when refueling.
19. Use safety equipment provided with the machine for your protection. A full-face respirator is required when loading, unloading or cleaning tanks.
20. Always be sure you have proper unit-to-unit ground before starting any maintenance or loading operations.
21. Smoking is prohibited when working around any paint equipment.
22. Relieve pressure before opening any pressurized tank or coupling.
23. Avoid contact with solvent, and wear approved respirators and eye protection.
24. Thoroughly clean solvent from skin as quickly as possible.
25. Flush eyes thoroughly with water in cases of eye contact with solvent or paint.
26. Dispose of all rags in an approved flameproof container.

27. Never make repairs or tighten hoses or fittings when the delivery system is under pressure.
28. Wear an approved respirator when hand spraying.
29. Practice good housekeeping and clean out the cab and operator's platform at the end of each day. It is the responsibility of the operator to inspect the equipment each shift. The use of defective or unsafe equipment is forbidden.
30. USE COMMON SENSE AND GOOD JUDGMENT.

#### BULK LOADING

Traffic paints are some of the most volatile materials used in maintenance operations. The potential for a major explosion and fire are always present with these materials. The danger can be reduced greatly by following established precautionary measures.

It is important to reduce static electricity. Static electricity is produced when non-conducting liquids flow through pipes or hoses, when liquids fall through the air in drops or as a spray, when they are splashed around in tanks or when air or other gases bubble through them.

Generation of static electricity cannot be prevented but dangerous accumulations can be. Electrical bonding and grounding equipment helps reduce the dangerous accumulations of static electricity.

Ground continuity must be checked in all piping, equipment, devices, cables and connections with an ohmmeter at the time of installation and every three months thereafter. This electrically conductive path should have a resistance of less than 25 ohms.

Ground continuity must be established between each unit of the storage, transportation or application equipment. Appendix A contains illustrations explaining approved methods for insuring ground continuity. When paint is transferred from one unit to another, the units have to be properly grounded to each other before any other connections between units are made, any valves are opened or pumps are turned on.



Paint storage tanks must be grounded throughout the entire system. An 8-foot ground rod driven in the ground with no more than 6 inches of that rod above ground level is acceptable. A  $\frac{1}{4}$ -inch ground cable grounds the system to the rod. Continuity must be checked from each individual piece of the system to adjacent pieces. For example, check continuity from the length of pipe going into an elbow and from the elbow to the next length of pipe. Joint compound, teflon tape or leaking paint could block the current path at joints. If the ohmmeter reads 25 or more ohms of resistance, a pipe grounding jumper assembly must be installed if the joint cannot be cleaned enough to establish continuity. Pipe to pipe illustrated in SA-9 on page A-10 in Appendix A.

The flexible hoses used to transfer paint between the tanks and the trucks have grounding wire built into them. The hose should be cut so that a few inches of that wire can be tucked back into the hose and grounded to the coupling on each end. In addition to this ground, each nurse truck should be equipped with a static electricity discharge reel. This retractable cable has to be attached to the ground ball coupling on the bulk storage tanks or the striper. This ground coupling is the first thing hooked up and the last thing unhooked.

The two 1000-gallon paint tanks on the nurse trucks are positioned directly over the rear axles. This position puts virtually the entire load on those axles. When loading beads, load them as far forward as possible for improved weight distribution. The paint weighs approximately 12.45 pounds per gallon. A legal load for the nurse truck is 1100 gallons of paint and the 6600 pounds of bead needed at 6 pounds per gallon of paint. If the beads are carried on another vehicle, the nurse truck can legally carry 1600 gallons of paint.

The nurse truck tanks have no baffles, to facilitate cleaning. The absence of baffles could cause varying degrees of instability under certain operating conditions. When the tanks are not full, the paint may surge in sudden or abrupt maneuvers. Sudden stops or erratic driving could cause the cargo to shift.

CONNECTING AND DISCONNECTING GROUNDING CABLES MUST ALWAYS BE THE FIRST AND LAST OPERATIONS IN MATERIAL TRANSFER PROCEDURES.

When loading to or from the nurse truck, connect the static electricity discharge cable to the ground ball coupling on the bulk storage tanks or the striper before making any other connections or turning on any pumps. Clean all couplings before making connections. Release the pressure relief valves on the tanks. Turn on the pumps and open the necessary valves. When loading is completed, close the valves and turn off the pumps. Take necessary precautions to minimize spillage when disconnecting the lines. Clean the couplings to prevent paint from drying on union surfaces and threads. When all other operations are complete, disconnect the static electricity discharge cable. Connecting and disconnecting this cable must always be the first and last operations in material transfer procedures.

#### TRAFFIC CONTROL

Mobile operations like striping require special traffic control procedures. The work site actually moves along the roadway and all of the areas of the traffic control zone must move along with the operation. Each area of the traffic control zone must perform its intended function even though it is constantly moving. These situations will fall into two major groups: a multi-lane roadway with one-way traffic; or a roadway with traffic opposing the striping operation.

In either situation, the traffic control must serve a twofold purpose. The first and most important purpose is to protect workers, equipment, the public and their vehicles. The secondary purpose of the traffic control is to protect the paint until it dries. Scheduling striping operations for off-peak hours will help, simply by having fewer vehicles to be concerned with. Faster drying paints have reduced the length of time the traffic control is required to protect the work.

The advance warning area of the traffic control zone moves with the work area. This is accomplished by the use of shadow vehicles in advance of or following the striping equipment. If traffic volumes are light and sight distances are good, one well marked and signed shadow vehicle may suffice. If traffic volumes and/or speeds are higher, additional shadow or backup vehicles should follow the striping equipment.



For operations on multi-lane roadways with one-way traffic a shadow vehicle leading the striper is not required. At least one shadow vehicle is required following at least 500 feet. The number required depends on speed, visibility and drying time. Shadow vehicles must always be far enough behind the striper, so they do not obstruct other drivers' view of the equipment. On multi-lane divided highways, when traffic is moved to another lane, two shadow vehicles may be required. They should be spread out following the striper to warn drivers off of the wet paint. Additional shadow vehicles may be required to keep traffic off of the wet stripes in situations with high traffic volumes, poor sight distances or longer drying times. Shadow vehicles that don't have flashing arrow boards should be equipped with appropriate signs: Wet Paint, Keep Left, Keep Right, Right Lane Closed, Left Lane Closed.

DRYING TIME TRAVEL DISTANCES

M P H	8							
	9	0.2	0.3	0.5	0.6	0.8	0.9	1.1
	10							1.2
	11							
	12	0.2	0.4	0.6	0.8	1.0	1.2	1.4
	13							1.6
	14							
	15	0.3	0.5	0.8	1.0	1.2	1.5	1.8
	16							2.0
	17							
	18	0.3	0.6	0.9	1.2	1.5	1.8	2.1
	19							2.4
	20							
	1	2	3	4	5	6	7	8
Minutes of Drying Time								

For striping on two-way roads, an advance warning vehicle ahead of the striper is needed to warn oncoming traffic. The following shadow vehicles required would depend on traffic volume, sight distance and drying time. Additional signs that could be used on shadow vehicles in this situation would be: Do Not Pass and One Lane Road Ahead. With this type of control, shadow and work vehicles should pull over periodically to allow traffic to pass.

## EFFECTIVE OPERATION

A striping operation is a team effort. There will be at least one striper operator, the striper driver and the nurse truck driver. The striper is equipped with an intercom at each operator's station. Keep in contact with the truck driver and any other operators on the striping machine. There may also be additional shadow vehicle drivers to maintain contact with.

The following list contains points that can assist you in maintaining an effective level of operation.

- A. Perform all pre-start inspection and maintenance procedures (see Procedure Sheet #1)
- B. Set pressures according to manufacturer's recommendations
- C. Know all controls and their functions
- D. Make test passes before leaving for the work site; make necessary adjustments identified in the tests
- E. Keep alert; watch for changes in skip and solid lines and for breaks in lines

EXAMPLES: Edge line goes off at intersections, driveways; center line goes to skip and solid in no-passing zones

- F. Know signals and keep in contact with other crew members

EXAMPLE: Advise driver if truck is moving too fast or slow for good coverage

- G. Clean shrouds often

(NOTE: Scrape the inside with a knife so that paint will not build up and leave ragged edges on the stripes.)

- H. Keep beads dry
- I. Adjust nozzle height and angle as needed

EXAMPLES: Nozzle height adjusts width of line; nozzle is angled for painting curbs

J. Make changes gradually

EXAMPLES: Narrowing road, changing from four lanes to two lanes

K. Paint new lines on top of existing lines

(NOTE: Use advance-retard switch to match center line cycle. Keep edge lines aligned with existing stripes.)

L. Operate advance-retard switch with short jogs until cycles match

(NOTE: Change pattern gradually; it may take several skips to match existing cycle.)

M. Empty extractors often

## PROCEDURE SHEETS

The five procedure sheets on the following pages cover the major operations essential to striping equipment. Each sheet lists the equipment and materials necessary to accomplish the procedures described in the other section. They can be used as a guide or reproduced and actually used as check sheets. They could be very useful for acquainting new operators with essential procedures.

PROCEDURE SHEET #1  
PRE-START, INSPECTION AND MAINTENANCE PROCEDURES

I. EQUIPMENT AND MATERIALS

- ☐/ A. Striping machine
- ☐/ B. Operator's manual
- ☐/ C. Engine oil
- ☐/ D. Engine coolant
- ☐/ E. Hydraulic fluid
- ☐/ F. Fuel
- ☐/ G. Solvent
- ☐/ H. Lubricants
- ☐/ I. Grease gun
- ☐/ J. Rags
- ☐/ K. Necessary wrenches
- ☐/ L. Hose fittings, hoses and couplings
- ☐/ M. Static discharge reel, grounding cables and clamps
- ☐/ N. Face mask and respirator
- ☐/ O. EMS-I Operator Usage Report

II. PROCEDURE

(NOTE: Deficiencies should be corrected immediately or reported to the proper authority. Do not operate defective equipment.)

- ☐/ A. Make a walk-around visual inspection for broken, worn, or missing parts, and leaks
- ☐/ B. Check compressor engine oil level; add or change engine oil if necessary; enter amount on EMS-I
- ☐/ C. Check hydraulic reservoir level; add fluid if necessary

- \_\_\_/ D. Check fuel level; fill tanks if necessary
- \_\_\_/ E. Check compressor air cleaner; remove and clean filter if necessary
- \_\_\_/ F. Drain condensation from air tanks and fuel sight bowls
- \_\_\_/ G. Check engine coolant level; add coolant if needed (50/50 mixture)
- \_\_\_/ H. Check belts for tension and condition
- \_\_\_/ I. Check battery connections and electrolyte levels
- \_\_\_/ J. Clean all grease fittings and lubricate according to manufacturer's specifications
- \_\_\_/ K. Check hydraulic system for leaking lines or connections, bent or kinked lines, and lines rubbing against other parts
- \_\_\_/ L. Check electrical wire connections and insulation
- \_\_\_/ M. Check static discharge reels, grounding cables and clamps for cleanliness and connections  
  
(Note: The clamps must have adequate pressure to ensure a good bond when applied to ground connectors.)
- \_\_\_/ N. Check levers and controls for proper functioning
- \_\_\_/ O. Remove trash
- \_\_\_/ P. Check lights
- \_\_\_/ Q. Check safety devices
- \_\_\_/ R. Check paint level in tanks
- \_\_\_/ S. Check condition of lines and hoses, fittings and couplings
- \_\_\_/ T. Check gun carriage tires
- \_\_\_/ U. Check all valves for appropriate open or closed positions

- ☐ / V. Check condition of nozzles; clean shrouds if necessary
- ☐ / W. Check pumps
- ☐ / X. Check pressure gauges and regulators for all material tanks
- ☐ / Y. Conduct complete pre-start inspection on the truck
- ☐ / Z. Dispose of all rags in an approved flameproof container





## PROCEDURE SHEET #2 - OPERATOR SERVICE

### I. EQUIPMENT AND MATERIALS

- ☐/ A. Striping machine
- ☐/ B. Operator's manual
- ☐/ C. Tool kit
- ☐/ D. Grease gun
- ☐/ E. Lubricants
- ☐/ F. Cleaning solvents
- ☐/ G. Rags
- ☐/ H. Water
- ☐/ I. Engine coolant
- ☐/ J. Engine oil
- ☐/ K. Hydraulic fluid
- ☐/ L. Fuel
- ☐/ M. Face mask and respirator
- ☐/ N. EMS-I - Operator Usage Report

### II. PROCEDURE

(NOTE: Follow departmental preventive maintenance program when servicing equipment. Refer to operator's manual for lubrication chart and for servicing specific components and attachments.)

- ☐/ A. Connect static electricity discharge reel to a proper grounding assembly
- ☐/ B. Visually inspect for leaks and broken, worn, or missing parts

(NOTE: Major repairs and replacements should be reported to the proper authority and completed by a trained mechanic.)

\_\_\_/ C. Check compressor engine oil level, filter, lines, and hoses; add engine oil if needed; change if due; enter on EMS-I

\_\_\_/ D. Check compressor engine coolant level, radiator cap, hose, and radiator; add coolant if needed (50/50 mixture)

(CAUTION: Do not remove radiator cap unless engine is cool; then, open cap slowly to release pressure.)

\_\_\_/ E. Clean air filter; replace if necessary

\_\_\_/ F. Check fuel level, fuel filters, and sediment bowl (where applicable); fill fuel tank if necessary

\_\_\_/ G. Check hydraulic fluid level, filters, hoses, lines, and fittings; look for leaks; add fluid if needed

\_\_\_/ H. Check wiring, insulation, and connections

\_\_\_/ I. Clean and lubricate all grease fittings according to manufacturer's recommendations

\_\_\_/ J. Check all safety devices; repair if necessary

\_\_\_/ K. Check all major components and/or accessories

\_\_\_/ L. Check all systems for proper function

\_\_\_/ M. Check continuity through all grounding components, proper clamp pressure and connections on each unit

\_\_\_/ N. Check air and material lines for leaks or poor connections; replace if necessary

\_\_\_/ O. Check pumps for proper function; adjust as needed

\_\_\_/ P. Check guns and nozzles for wear and proper functioning; adjust or replace as needed

\_\_\_/ Q. Check regulators for proper functioning;  
repair or adjust if necessary

(NOTE: Check diaphragm and needle valve  
if regulator is not working properly.)

\_\_\_/ R. Dispose of all rags in an approved  
flameproof container



PROCEDURE SHEET #3 -  
START-UP AND OPERATIONAL CHECK

I. EQUIPMENT, MATERIALS AND PERSONNEL

- ☐/ A. Striping machine
- ☐/ B. Operator's manuals for striping machine, pumps, compressor, guns
- ☐/ C. Wrenches
- ☐/ D. Paint (yellow and white)
- ☐/ E. Solvent
- ☐/ F. Glass beads
- ☐/ G. Hose fittings, hoses and couplings
- ☐/ H. Static discharge reel, grounding cables and clamps
- ☐/ I. Face mask and respirator
- ☐/ J. Driver
- ☐/ K. Crew members as needed for operation and signaling
- ☐/ L. EMS-I - Operator Usage Report

II. PREPARATION FOR STRIPING

(NOTE: These are general procedures for operating a striper. Check for specific procedures on your machine.)

- ☐/ A. Attach static electricity discharge reel to ground unit-to-unit
- ☐/ B. Perform all pre-start inspection and maintenance procedures
- ☐/ C. Start compressor, if used, and allow it to warm up
- ☐/ D. Locate and identify all controls, lines, and valves for your unit
- ☐/ E. Be sure valves are in the correct open or closed positions

\_\_\_/ F. Load paint according to type of unit

EXAMPLES: Pressure pot -- Ground barrels  
before opening, stir paint,  
insert pump line, open main  
valves, turn on pumps

Pressure pump -- Ground unit  
to unit; make connections;  
turn on pumps

\_\_\_/ G. Load beads

\_\_\_/ H. Start agitators if used

\_\_\_/ I. Start heaters if used

\_\_\_/ J. Start pumps

\_\_\_/ K. Lower carriages

\_\_\_/ L. Set gun height and angle by loosening  
set screws, adjusting nozzle, and then  
tightening screws

\_\_\_/ M. Blow out lines with solvent

\_\_\_/ N. Run paint through guns; check pattern

\_\_\_/ O. Make adjustments as needed

(NOTE: See operator's manual for spray  
guns.)

EXAMPLES: Adjust air valve  
Adjust fluid intake valve  
Clean regulator  
Adjust pattern control  
Clean nozzle tip  
Clean needle valve  
Clean shroud  
Adjust height or angle of guns

\_\_\_/ P. Raise carriages

\_\_\_/ Q. Set cycle according to departmental  
standards

\_\_\_/ R. Set footmeter to zero

\_\_\_/ S. Signal other crew members when adjust-  
ments are complete

### III. PROCEDURE FOR STRIPING

- \_\_\_/ A. Make sure all controls are in proper preset positions  
  
EXAMPLES: Pressure regulators set  
Control valves in proper setting  
Gun controls on switch box in OFF position  
Activate arrow board
- \_\_\_/ B. Lower timing wheel; or set metering devices
- \_\_\_/ C. Take position at right operator's station
- \_\_\_/ D. Lower carriage and extend the carriage to proper position
- \_\_\_/ E. Activate master switch
- \_\_\_/ F. Activate timing system
- \_\_\_/ G. Signal truck driver that you are ready
- \_\_\_/ H. At operator's signal, activate right gun, right-hand carriage to paint edge line
- \_\_\_/ I. Practice stopping and starting line as needed
- \_\_\_/ J. Adjust position of carriage as needed to keep line straight and even and matched with existing line
- \_\_\_/ K. At end of practice, turn switches off and signal the driver  
  
(NOTE: Retract the right-side carriage, raise it, and secure the safety chains.)
- \_\_\_/ L. Move to left operator's station
- \_\_\_/ M. Check all valves and switches for proper preset positions
- \_\_\_/ N. Lower and extend left carriage
- \_\_\_/ O. Signal the driver when you are ready

\_\_\_/ P. At the driver's signal, switch on outside gun and paint a solid line

\_\_\_/ Q. Operate all guns in solid and skip pattern

\_\_\_/ R. Practice advancing and retarding the skip

(NOTE: Jog switch on and off quickly; don't hold the switch in the ON position for more than 1 second. Then return to the OFF position.)

\_\_\_/ S. Practice switching for different markings

EXAMPLES: Skip line  
No passing zone  
Double yellow line  
Switch off all guns  
Double yellow line at intersection approaches, changing to skip and single line  
No passing zone to skip line shifts

\_\_\_/ T. Signal the driver to stop when practice is completed or if any problems arise

(NOTE: When operation stops, clean the shrouds.)

\_\_\_/ U. At end of practice, shut off guns

\_\_\_/ V. Proceed to a work site or shut down the equipment



## PROCEDURE SHEET #4 - SHUTDOWN

### I. EQUIPMENT, MATERIALS AND PERSONNEL

- ☐/ A. Striping machine
- ☐/ B. Operator's manuals for striping machine, pumps, compressor, guns
- ☐/ C. Wrenches
- ☐/ D. Solvent
- ☐/ E. Static discharge reel, grounding cables and clamps
- ☐/ F. Face mask and respirator
- ☐/ G. Driver

### II. SHUTDOWN

- ☐/ A. Signal driver to stop
- ☐/ B. Shut off paint; open solvent valve to clean lines and guns
- ☐/ C. Bleed system pressure as needed
- ☐/ D. Shut off guns
- ☐/ E. Scrape shrouds  
(NOTE: Whenever operations stop, clean the shrouds.)
- ☐/ F. Raise timing wheel
- ☐/ G. Retract and raise carriages and secure safety chains
- ☐/ H. Shut down regulators
- ☐/ I. Shut down as equipped: heaters, pumps, compressor  
(NOTE: Allow compressor to run at idle with no load for three to five minutes.)
- ☐/ J. Dispose of all rags in an approved flameproof container



PROCEDURE SHEET #5  
BULK LOADING

I. EQUIPMENT AND MATERIALS

- ☐/ A. Striping machine
- ☐/ B. Nurse truck
- ☐/ C. Bulk paint storage tanks
- ☐/ D. Paint (yellow and white)
- ☐/ E. Operator's manuals for all equipment
- ☐/ F. Solvent
- ☐/ G. Hose fittings, hoses and couplings
- ☐/ H. Static discharge reel, ground cables and couplings
- ☐/ I. Face mask and respirator
- ☐/ J. Wrenches
- ☐/ K. Glass beads
- ☐/ L. Rags

II. BOTTOM LOADING FROM THE BULK STORAGE TANKS TO THE NURSE TRUCK OR STRIPER

- ☐/ A. Make a walk-around visual inspection for broken, worn, or missing parts and leaks
- ☐/ B. Connect the static discharge cable from the nurse truck to the ground ball on the tank
- ☐/ C. Bleed a small quantity of material from lines to clear contamination  
  
(Note: Catch material bled from the lines into a bucket so it can be properly disposed of.)
- ☐/ D. Clean and connect couplings necessary for material transfer
- ☐/ E. Release the pressure relief valves on the tanks

- \_\_\_/ F. Turn on the pumps and open the necessary valves to transfer material
- \_\_\_/ G. Turn off the pumps and close the valves
- \_\_\_/ H. Disconnect the hoses

(Note: Catch any excess material in a bucket so it can be properly disposed of.)

- \_\_\_/ I. Clean and secure all couplings and hoses
- \_\_\_/ J. Disconnect the static discharge cable
- \_\_\_/ K. Dispose of all rags in an approved flameproof container
- \_\_\_/ L. Dispose of waste paint

### III. BOTTOM LOADING FROM THE NURSE TRUCK TO THE STRIPER

- \_\_\_/ A. Make a walk-around visual inspection for broken, worn, or missing parts and leaks
- \_\_\_/ B. Connect the static discharge cable from the nurse truck to the ground ball on the striper
- \_\_\_/ C. Bleed a small quantity of material from lines to clear contamination

(Note: Catch material bled from the lines into a bucket so it can be properly disposed of.)

- \_\_\_/ D. Clean and connect couplings necessary for material transfer
- \_\_\_/ E. Release the pressure relief valves on the tanks
- \_\_\_/ F. Turn on the pumps and open the necessary valves to transfer material
- \_\_\_/ G. Turn off the pumps and close the valves
- \_\_\_/ H. Disconnect the hoses

(Note: Catch any excess material in a bucket so it can be properly disposed of.)

- \_\_\_/ I. Clean and secure all couplings and hoses
- \_\_\_/ J. Disconnect the static discharge cable
- \_\_\_/ K. Dispose of all rags in an approved flameproof container
- \_\_\_/ L. Dispose of waste paint

VI. TOP LOADING TO THE NURSE TRUCK OR THE STRIPER

- \_\_\_/ A. Make a walk-around visual inspection for broken, worn, or missing parts and leaks
- \_\_\_/ B. Connect the static discharge cable from the nurse truck to the ground ball on the tank
- \_\_\_/ C. Connect a ground cable from the hatch to the filler hose coupling
- \_\_\_/ D. Bleed a small quantity of material from lines to clear contamination

(Note: Catch material bled from the lines into a bucket so it can be properly disposed of.)

- \_\_\_/ E. Open the hatch cover  
  
(Note: Wear the face mask and respirator.)
- \_\_\_/ F. Clean couplings necessary for material transfer; insert through hatch
- \_\_\_/ G. Turn on the pumps and open the necessary valves to transfer material
- \_\_\_/ H. Turn off the pumps and close the valves
- \_\_\_/ I. Remove the hoses  
  
(Note: Catch any excess material in a bucket so it can be properly disposed of.)
- \_\_\_/ J. Clean and secure all couplings and hoses

- \_\_\_/ K. Disconnect the static discharge cable
- \_\_\_/ L. Dispose of all rags in an approved flameproof container
- \_\_\_/ M. Dispose of waste paint

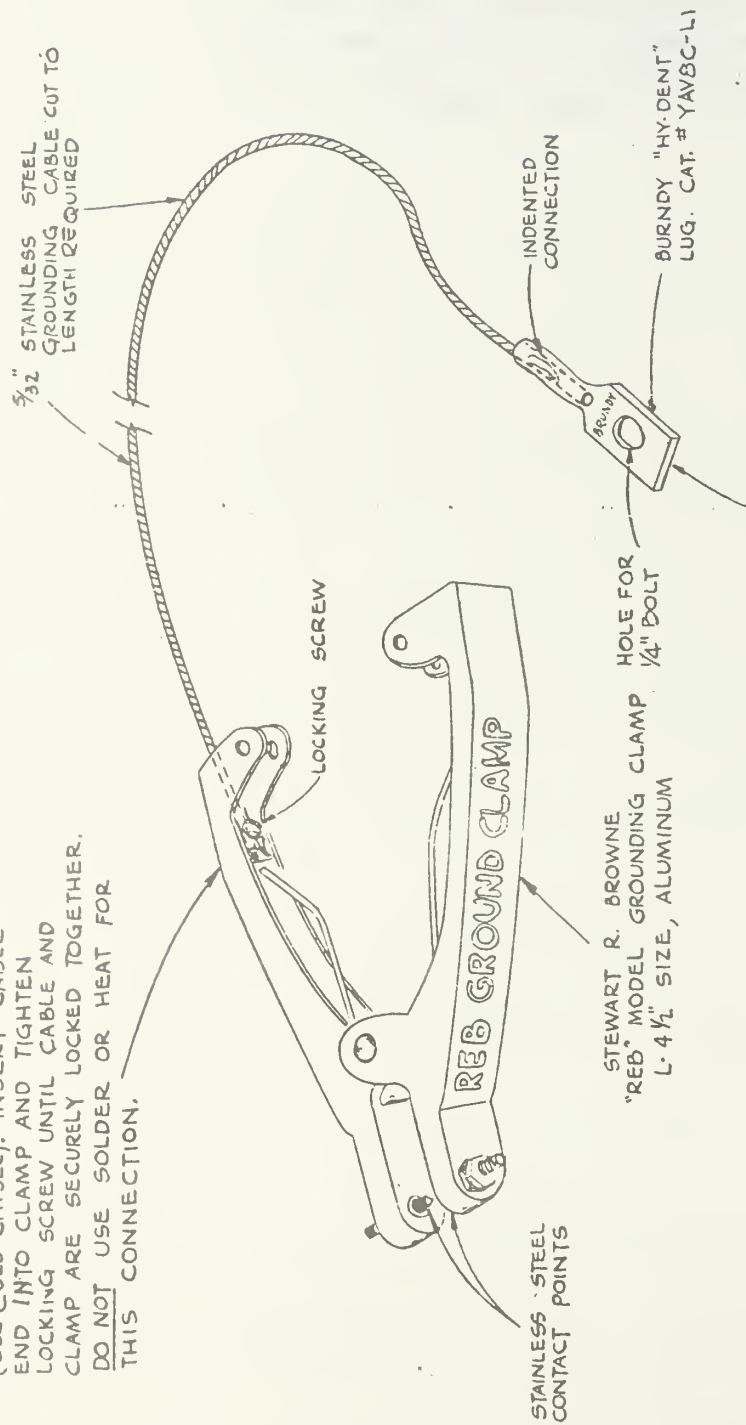
## APPENDIX A

### ELECTRICAL CONTINUITY GROUNDING EXAMPLES

This information has been approved by the Safety and Loss Prevention Committee of the National Paint and Coatings Association. The drawings are credited to the Sherwin-Williams Company.



CUT CABLE TO LENGTH REQUIRED (USE COLD CHISEL). INSERT CABLE END INTO CLAMP AND TIGHTEN LOCKING SCREW UNTIL CABLE AND CLAMP ARE SECURELY LOCKED TOGETHER. DO NOT USE SOLDER OR HEAT FOR THIS CONNECTION.



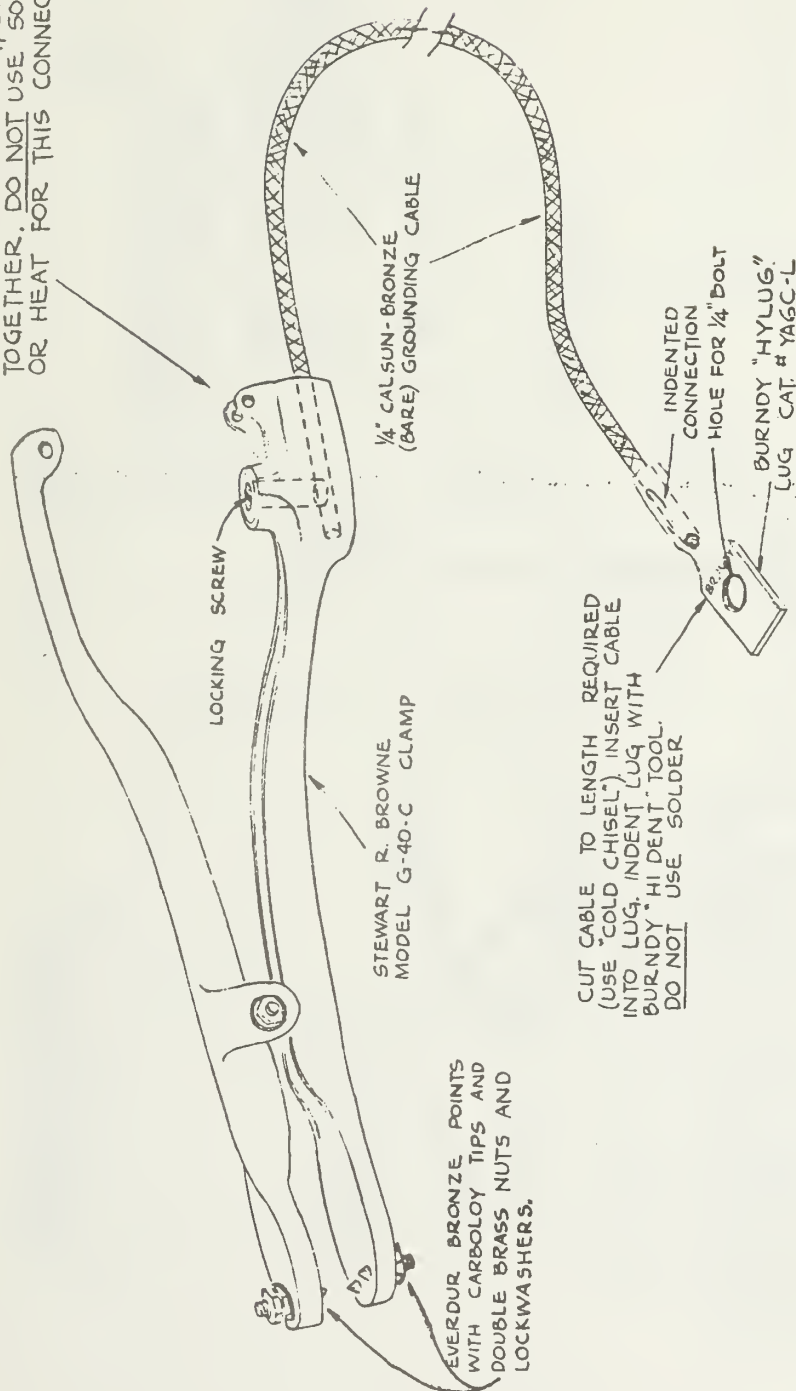
CUT CABLE (USE "COLD CHISEL")  
INSERT CABLE INTO LUG, INDENT  
LUG WITH BURNDY "HI-DENT" TOOL  
DO NOT USE SOLDER.

ALWAYS TEST FOR GROUND CONTINUITY

SMALL GROUND CLAMP  
STANDARD ASSEMBLY

SA-1

CUT CABLE TO LENGTH REQUIRED  
(USE "COLD CHISEL") INSERT CABLE  
END INTO CLAMP AND TIGHTEN  
LOCKING SCREW UNTILL CABLE  
AND CLAMP ARE SECURELY LOCKED  
TOGETHER. DO NOT USE SOLDER  
OR HEAT FOR THIS CONNECTION



ALWAYS TEST FOR GROUND CONTINUITY

LARGE: GROUND CLAMP  
STANDARD ASSEMBLY

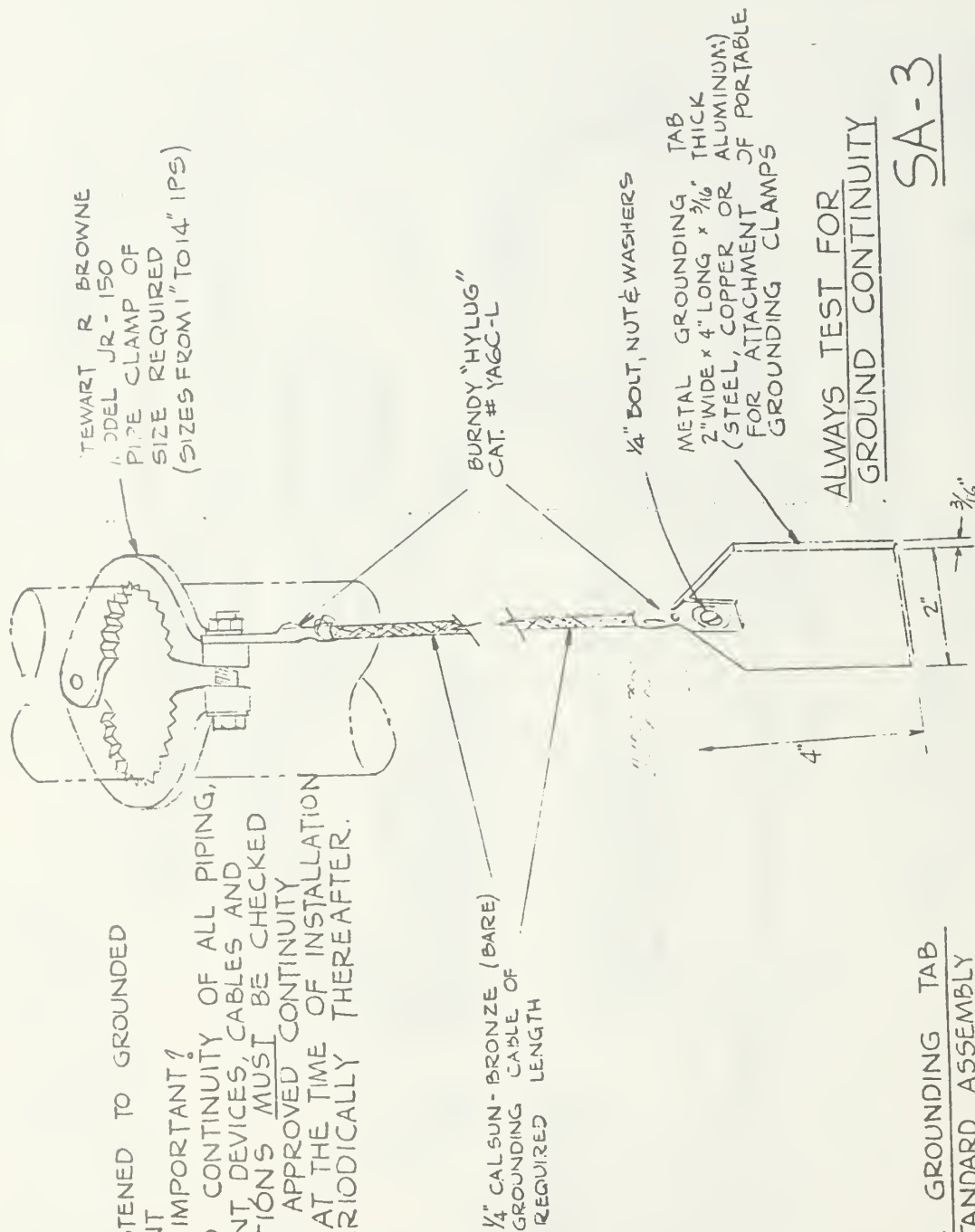
SA-2

PIPE FASTENED TO GROUNDED

EQUIPMENT

NOTE: IMPORTANT!

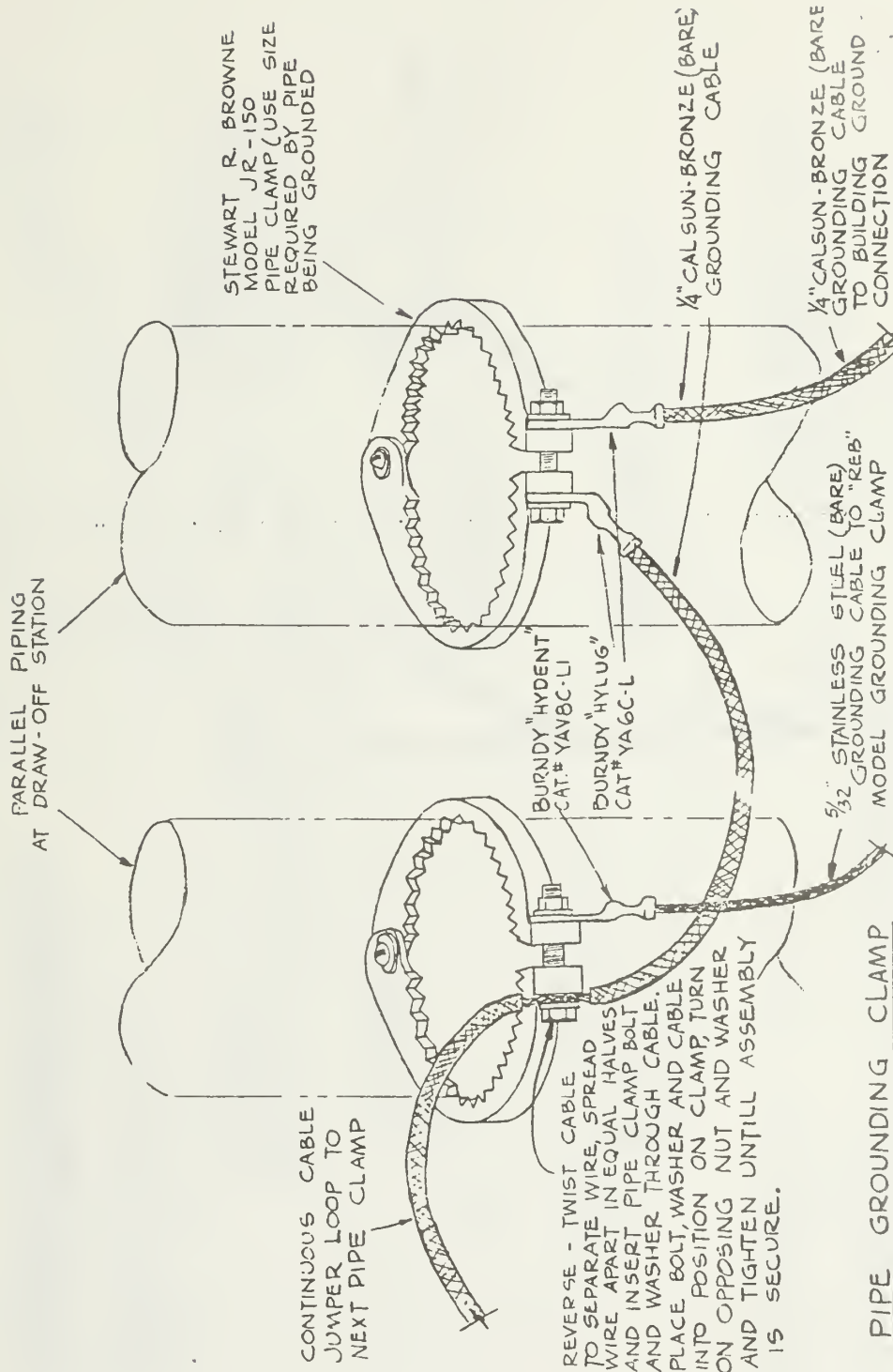
GROUND CONTINUITY OF ALL PIPING,  
EQUIPMENT DEVICES, CABLES AND  
CONNECTIONS MUST BE CHECKED  
WITH AN APPROVED CONTINUITY  
TESTER AT THE TIME OF INSTALLATION  
AND PERIODICALLY THEREAFTER.



PIPE GROUNDING TAB  
STANDARD ASSEMBLY

ALWAYS TEST FOR  
GROUND CONTINUITY

SA-3

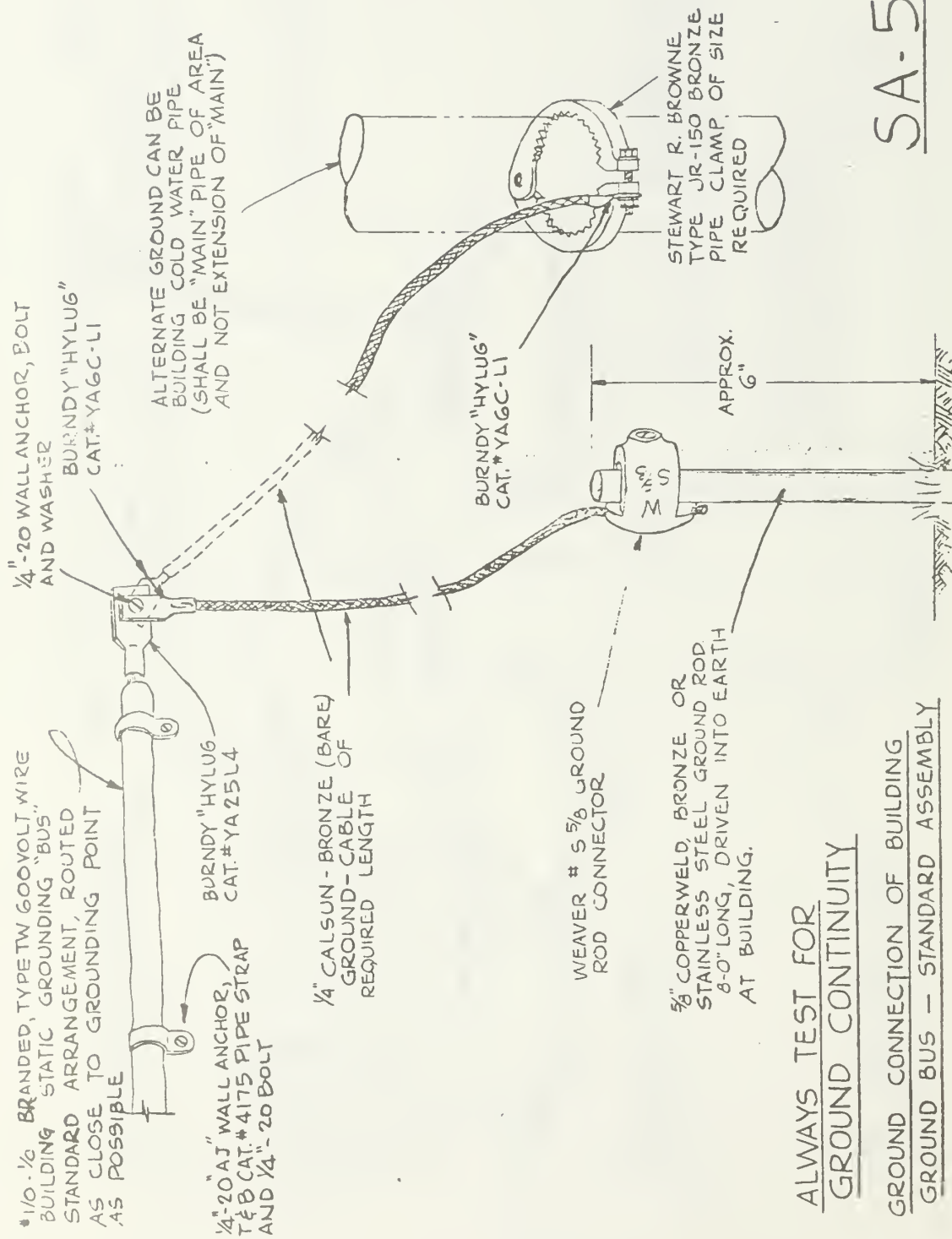


PIPE GROUNDING CLAMP

STANDARD ASSEMBLY

ALWAYS TEST FOR GROUND CONTINUITY

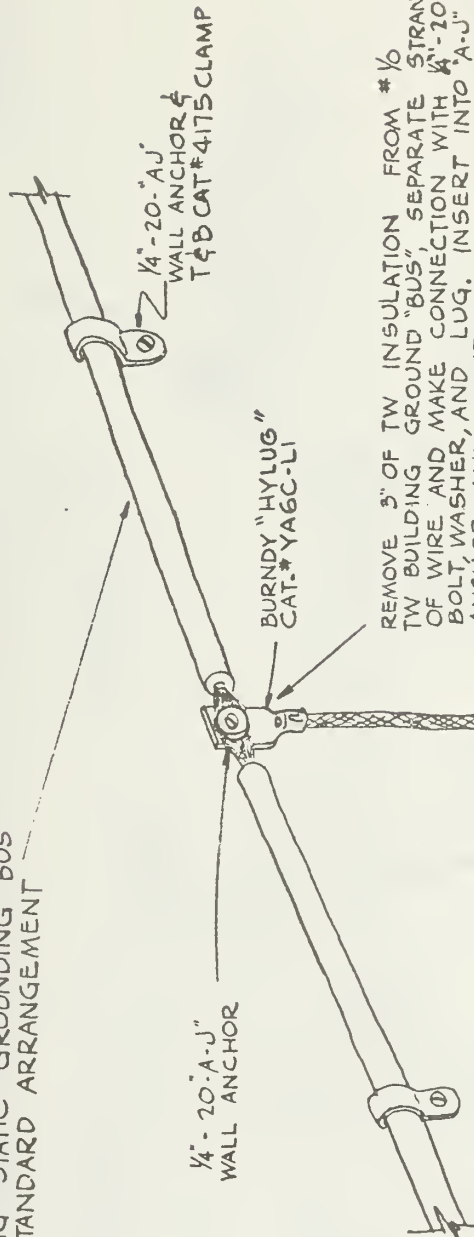
SA-4



ALWAYS TEST FOR  
GROUND CONTINUITY

GROUND CONNECTION OF BUILDING  
GROUND BUS - STANDARD ASSEMBLY

\*1/6-1/2 STRANDED TYPE TW 600V WIRE  
BUILDING STATIC GROUNDING "BUS"  
STANDARD ARRANGEMENT



1/4 CALSUN-BRONZE (BARE)  
GROUNDING CABLE OF LENGTH  
REQUIRED TO REACH EQUIPMENT  
TO BE GROUNDED

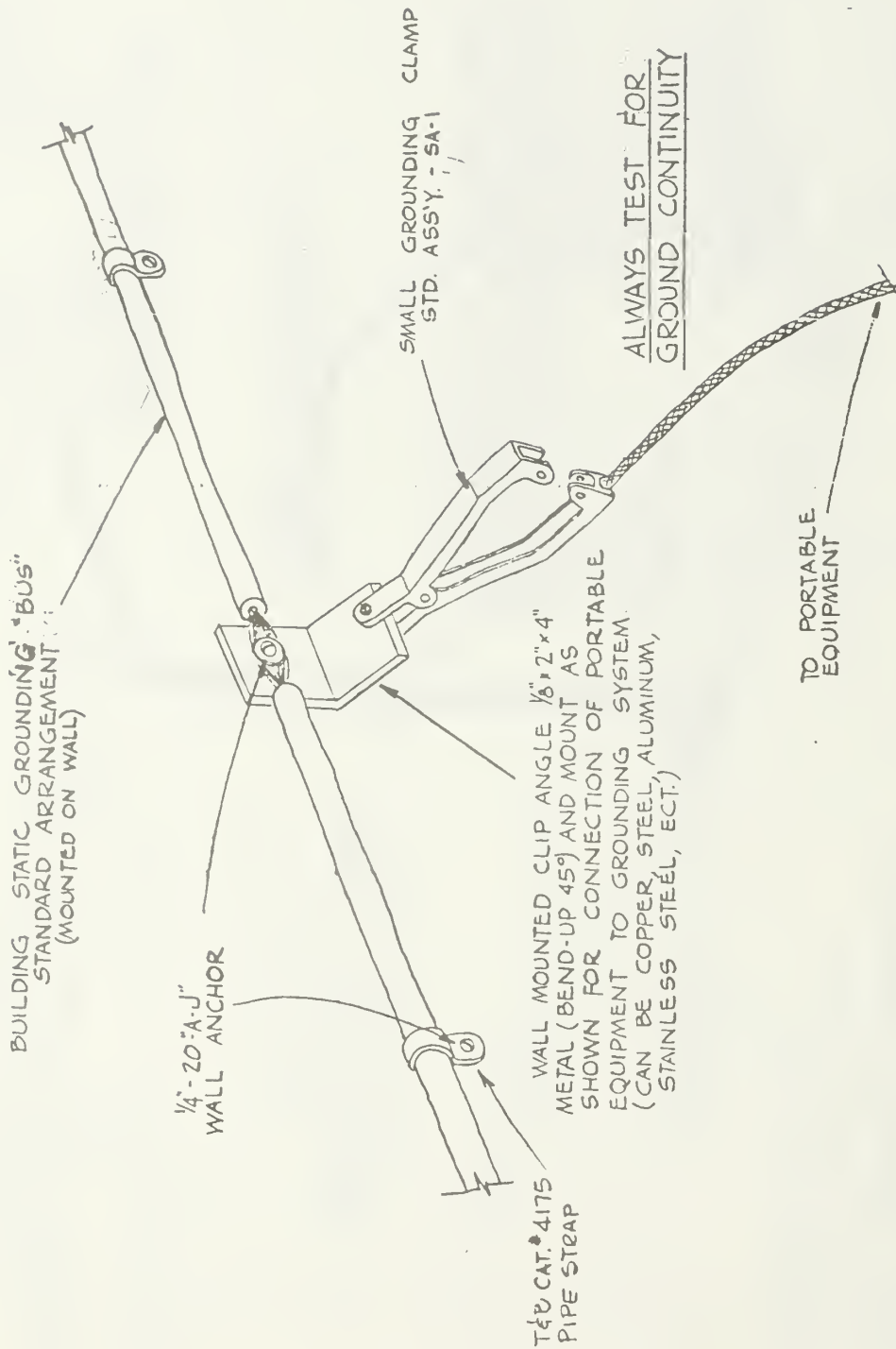
ALWAYS TEST FOR  
GROUND CONTINUITY

BURNDY "HYLUG"  
CAT. #YA6C-L1

PERMANENT - FIXED, EQUIPMENT GROUND  
EXTENSION TO BUILDING GROUND "BUS"  
STANDARD ASSEMBLY

SA-6

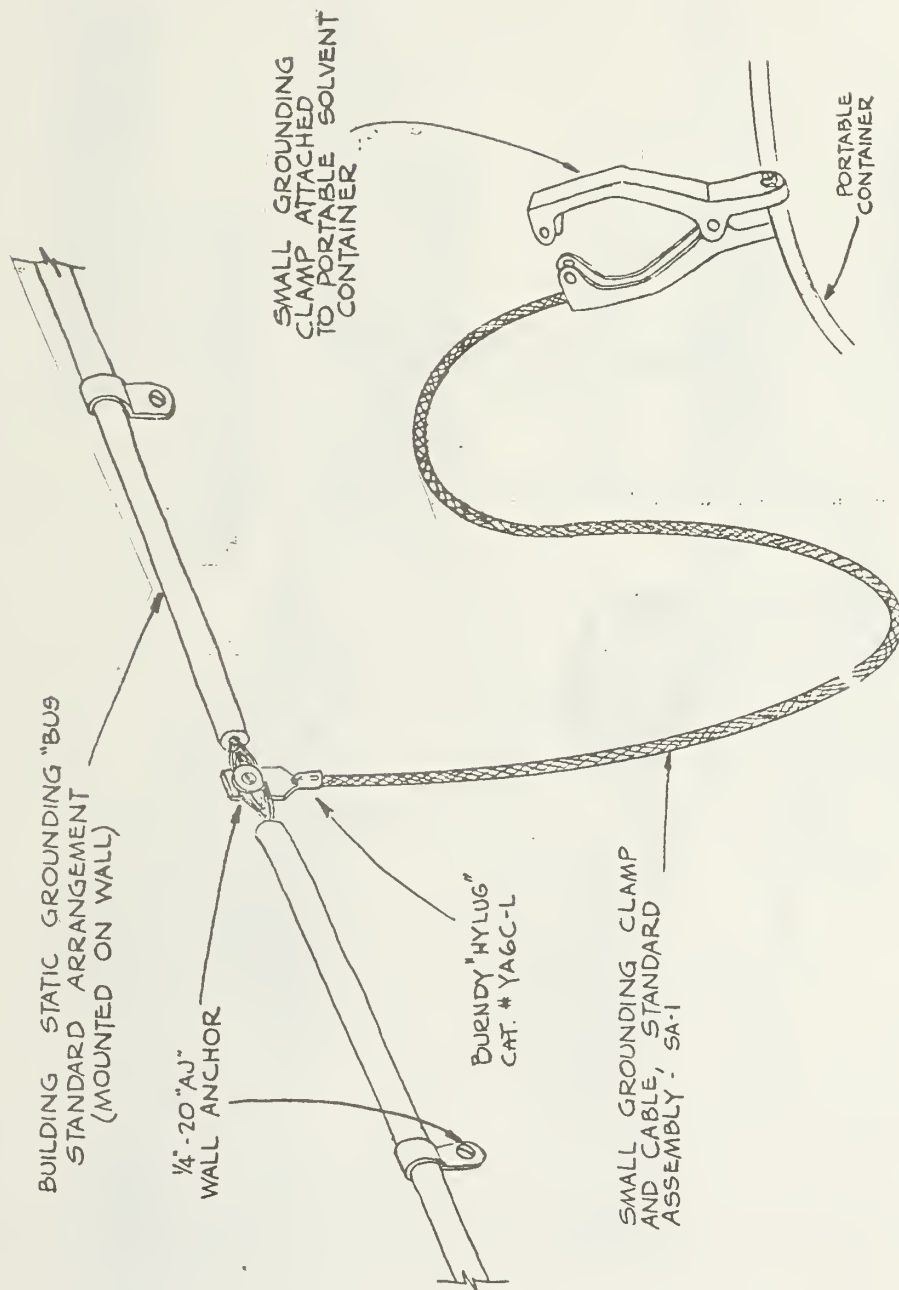




GROUNDING "TAP" CONNECTION TO BUILDING  
GROUND "BUS" - STANDARD ASSEMBLY

SA-7



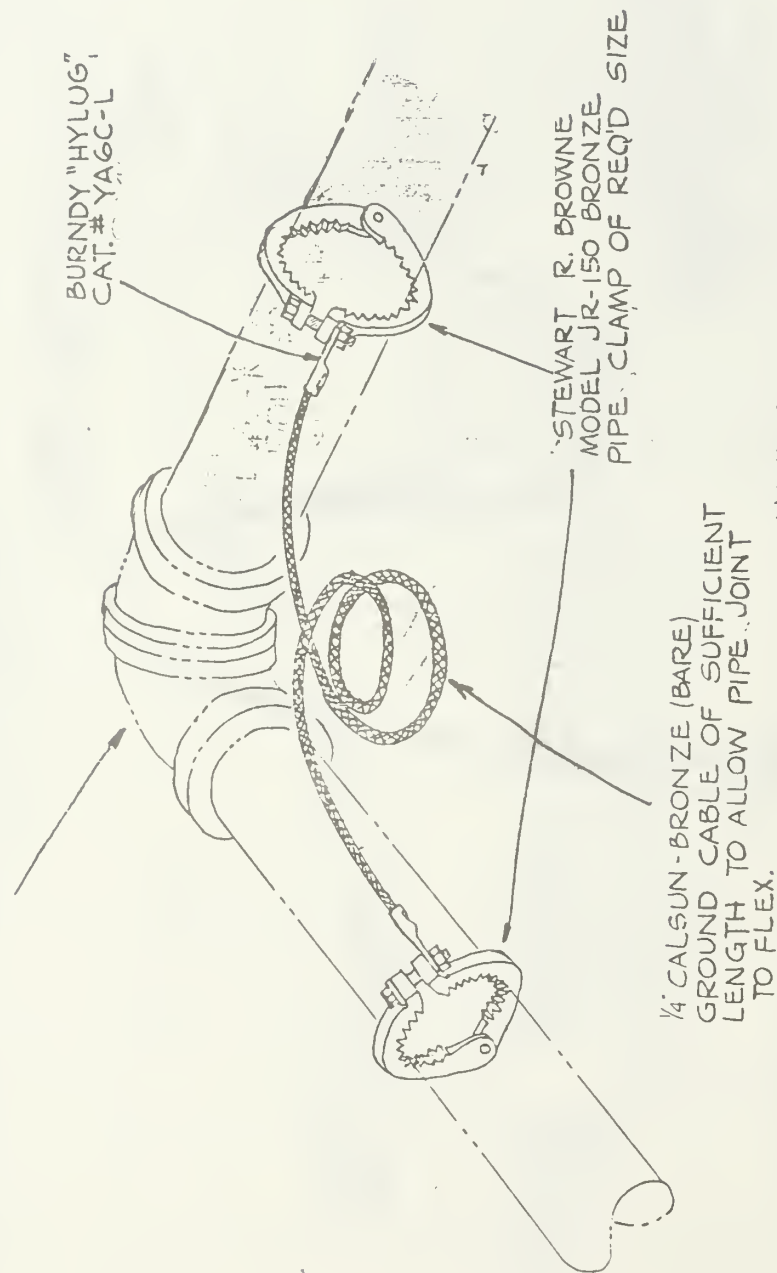


ALWAYS TEST FOR  
GROUND CONTINUITY

BUILDING GROUND "BUS" EXTENSION TO  
PORTABLE SOLVENT CONTAINERS - STANDARD ASSEMBLY

SA-8

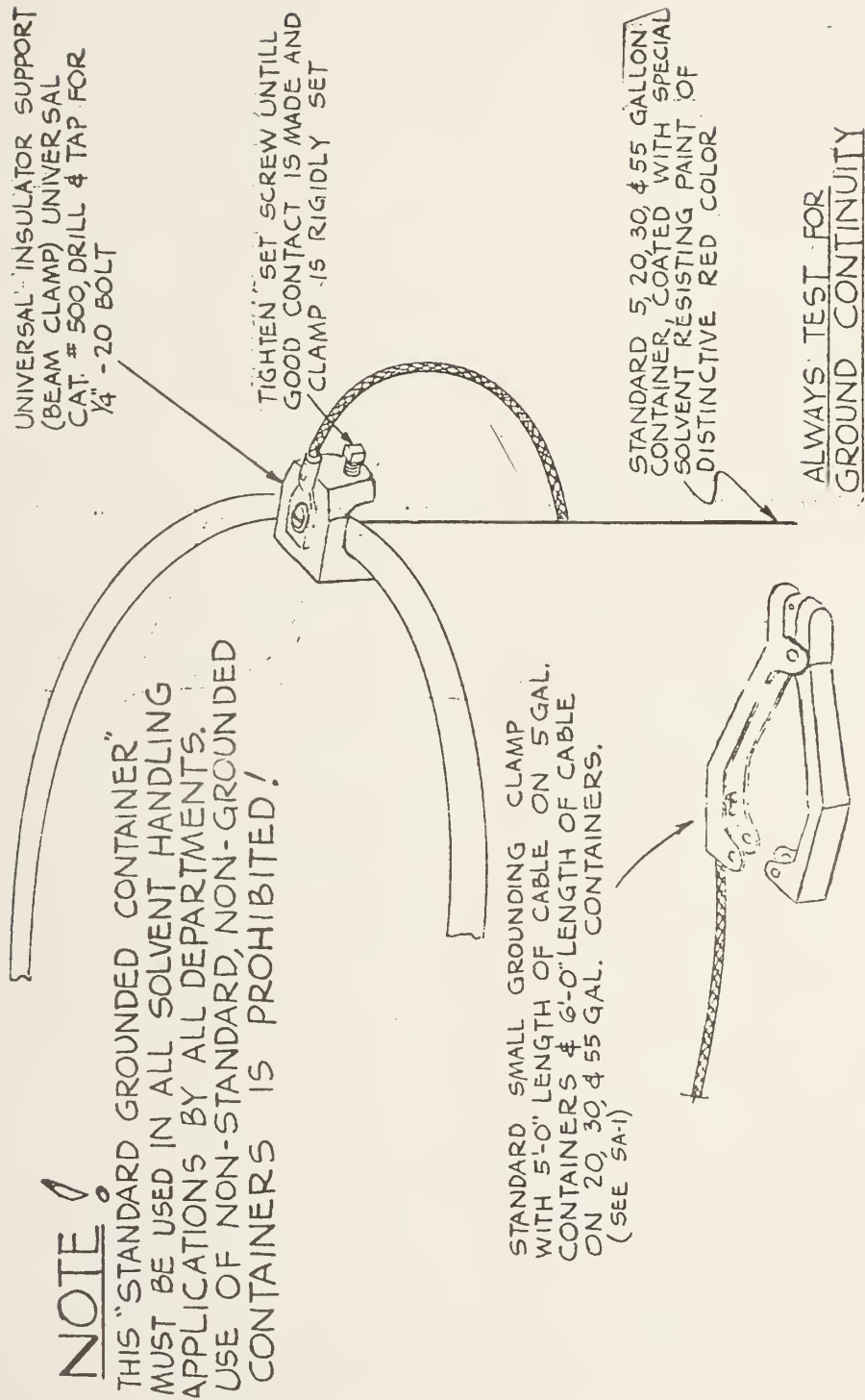
SOLVENT LOADING- UNLOADING  
PIPE WITH SWIVEL JOINT



ALWAYS TEST FOR  
GROUND CONTINUITY

PIPE GROUNDING JUMPER  
STANDARD ASSEMBLY

SA-9



TYPICAL ARRANGEMENT FOR GROUNDING 5, 20, 30 AND 55 GALLON CONTAINERS FOR SOLVENT HANDLING

TA-1





